Claims:

We claim:

1. An apparatus for filtering a liquid in a tank comprising,

a) a plurality of elements, each having,

(i) an upper header;

(ii) a lower header;

(iii) a plurality of hollow fibre membranes attached to and suspended between the headers, the membranes having each at least one open end and an outer surface, the outer surface of the open ends of the membranes connected to at least one header with a water impermeable connection; and,

(iv) one or more permeate channels in at least one of the headers in fluid communication with the interior of the hollow fibre membranes for collecting permeate;

b) a frame for holding the plurality of elements while the membranes are immersed in the liquid in the tank; and,

c) releasable attachments between the headers of the elements and the frame allowing the frame to releasably hold the elements by their headers,

wherein the size and configuration of the frame determines the positions of the upper headers of each element relative to the lower headers of each element.

2. The apparatus of claim 1 wherein (d) the frame holds the plurality of elements in a position such that the membranes are generally vertical when immersed in the liquid in the tank, (e) the frame allows tank water to rise generally vertically through the frame and past the elements.

3. The apparatus of claim 2 wherein the releasable attachments include a track and slider mechanism between the frame and the upper headers to allow the upper headers to be slid from the frame.

4. The apparatus of claim 3 wherein the track and slider mechanism is adapted to support the element whenever at least about one quarter of the upper header is inserted into the frame.

5. The apparatus of claim 1 wherein the headers are elongated in shape and the frame holds the headers in a generally horizontal orientation when the membranes are immersed in the tank.

6. The apparatus of claim 1 wherein the releasable attachments between at least one end of the headers having a permeate channel and the frame are made through one or more permeate collection tubes.

7. The apparatus of claim 6 wherein the elements are attached to the frame in a back to back configuration separated by permeate collection tubes connected to the one or more permeate channels of the elements.

8. The apparatus of claim 1 wherein connections between the permeate channels and one or more permeate collection tubes attached to the frame are releasable and resealable connections which are made or broken automatically by the movements involved in attaching an element to the frame or removing an element from the frame.

9. The apparatus of claim 8 wherein pairs of headers are attached on either side of permeate collection tubes and fittings in communication with the permeate channels on one or more of the headers are offset from a centerline of the headers such that the pairs of headers may be installed at different horizontal spacings from each other.

10. The apparatus of claim 3 wherein each element has an associated releasable and resealable water tight fitting between the element and a permeate collector, the releasable and resealable water tight fitting being releasable by moving the element in a direction substantially parallel to the headers of the element and resealable by moving the element in a reverse direction.

11. The apparatus of claim 3 wherein the releasable attachments include a track and slider mechanism between the frame and the lower headers to allow the lower headers to be slid from the frame.

12. The apparatus of claim 3 wherein the releasable attachments includes releasable supports on the frame which engage with the ends of the lower header when the lower header is swung into position while the upper header is supported in the track and slider mechanism.

13. A filtration apparatus comprising;

a) a plurality of elements, each element having,
an upper header;
a lower header;
a plurality of hollow fibre membranes attached to and suspended between the headers, the hollow fibre membranes having each an outer surface and at least one open end, the outer surface of the open ends of the membranes connected to at least one header with a water impermeable connection; and,
one or more permeate channels in at least one of the headers in fluid communication with the interior of the hollow fibre membranes for collecting permeate; and,

b) a frame having cross bars for holding the headers of the elements,

wherein

c) the elements themselves have no means for preventing one header of an element from moving vertically in relation to the other header of that element; and,

d) he cross bars holding either the upper headers, the lower headers or both is movable relative to the remainder of the frame so as to permit adjustment of the degree of slack of the membranes.

14. A filtration apparatus comprising;

c) a plurality of elements, each element having,

an upper header;

a lower header;

a plurality of hollow fibre membranes attached to and suspended between the headers, the hollow fibre membranes having each an outer surface and at least one open end, the outer surface of the open ends of the membranes connected to at least one header with a water impermeable connection; and,

one or more permeate channels in at least one of the headers in fluid communication with the interior of the hollow fibre membranes for collecting permeate; and,

d) a frame having cross bars perpendicular to the headers for holding the headers of the elements,

wherein

e) the elements have keys which engage with slots in the cross bars to support the elements in the frame but permit the elements to be slid into or out of the frame in a direction parallel to the headers.

15. The apparatus of claim 14 wherein the elements themselves have no means for preventing one header of an element from moving vertically in relation to the other header of that element.

16. The apparatus of claim 14 wherein the elements have extensions at their backs to support themselves against adjacent elements while being inserted or removed from the frame, the extensions being arranged such that they do not interfere with the extensions of an adjacent element.

17. Two or more of the apparatus of any of claim 13 placed back to back with one or more permeate pipe between them and having fittings which permit an element of either cassette to be removed or replaced by sliding that element parallel to its headers whereby the fitting associated with that element is released or resealed.

18. The apparatus of claim 17 wherein the one or more permeate pipes includes a local permeate pipe associated with a small group of elements and fitted with a valve to isolate that group of elements, and a permeate collector connected to the local permeate pipes and located above water level at the height of larger permeate pipes around a tank.

19. The apparatus of claim 16 wherein the headers are made of an extruded body closed with caps and the extensions are provided on the back cap.

20. An apparatus for treating a liquid with membranes comprising:

(a) a plurality of elements, each having a membrane attached to a header having a permeate channel, the inside of the membrane being in fluid communication with the permeate channel;

(b) a frame, the frame configured such that water may flow vertically through the frame while the frame is oriented as in use; and,

(c) releasable attachments between the headers and the frame allowing the frame to hold the elements by their headers while the membranes are immersed in the tank

and to release elements individually by moving an element horizontally while the frame is oriented as in use.